

Gulf Stream - Boundary Interactions

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LONG-TERM GOAL

I seek to understand the influence of the Gulf Stream, as well as other midlatitude jets, on the surrounding ocean. The interrelations between meandering, recirculation and radiation of low frequency energy are of particular interest.

OBJECTIVES

The guiding hypothesis is that the meandering of western boundary currents acts as a wavemaker in the ocean. The meanders are quite depth independent and force mainly barotropic motions exterior to them. These motions propagate as low frequency Rossby waves and those to the north of the stream eventually become topographic Rossby waves as they begin to feel the bottom topography. Based on theoretical and numerical modeling of the Gulf Stream region, two areas of enhanced coupling are predicted: near Cape Hatteras and to the west of the Grand Banks. We wish to discover whether or not this process is observed in the ocean. It is possible that similar dynamics are at work near the Polar Front in the Japan/East Sea.

APPROACH

An array of current meters was deployed in late summer of 1995 on the Continental Rise to the west of the Grand Banks (near 53W) to record low frequency motions for a two year period. The array was composed of 2 lines of current meter moorings, one of which was coincident with a track of the Topex/Poseidon altimetric satellite. The equipment was recovered successfully in September 1997 and the resulting data is now being compared with the climatological data base for the region, as well as the altimetric information, to discover whether or not this is a region of enhanced low frequency energy. Another mooring has been maintained in the Japan/East Sea for a second year and recently recovered. Analysis, in cooperation with Korean scientists, will begin in the new year.

WORK COMPLETED

The majority of the instruments above 1000m depth that were recovered from the Grand Banks array suffered from degradation by biological growth on the rotors and vanes. We have developed a method, based on assumption that high frequency energy should remain more or less constant, to correct for the obvious reduction in speeds in the records. Lately we have been analyzing the records for evidence of topographic Rossby waves and links with the Gulf Stream through use of the Topex/Poseidon

measurements of seasurface elevation. The second setting of the Japan/East Sea mooring was recovered in October, 1998 bringing to an end our participation.

RESULTS

Our primary effort in the past year was part of a continuing project with graduate student Steve Jayne to model, in an highly idealized sense, the production of recirculations by instabilities of a meandering jet. The recent work, now submitted, concerned the effect of stratification and refined a theoretical model.

The first setting of the Japan/East Sea mooring shows some interesting hints of a seasonal signal in the eddy field that is in contrast to the work of Prof. Takematsu (U.Kyushu) from north of the Polar Front. We see an enhancement of the eddy field during summer months whereas winter is the favored period further north. It will be interesting to see if this holds up with the second setting.

IMPACT/APPLICATION

We anticipate that the work with the current meter data set will give a better understanding of the origins of the energetic low frequency motion field that is observed on the Continental Slope and Rise. These motions are a dominant part of the total energy in these regions.

Although our fieldwork in the Japan/East Sea has ended we expect that our single mooring will provide important information to modelers. It is the only such mooring, south of the Polar Front and north of the Tsushima Strait, of which we are aware.

PUBLICATIONS

Nelson G. Hogg, Gerold Siedler and Walter Zenk 1998: Circulation and variability at the southern boundary of the Brazil Basin, *Journal of Physical Oceanography*, in press.

Nelson G. Hogg and W. Brechner Owens, 1999: Direct measurement of the deep circulation within the Brazil Basin, *Deep-Sea Research*, in press.

Walter Zenk, Gerold Siedler, Bernd Lenz and Nelson G. Hogg, 1999: Antarctic Bottom Water flow through the Hunter Channel, *Journal of Physical Oceanography*, submitted.

Steven R. Jayne and Nelson G. Hogg, 1999: A note on recirculation forced by an unstable jet, *Journal of Physical Oceanography*, submitted.